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ABSTRACT

This paper describes competency-based systems and system components in vocational and occupational education and other areas of elementary, secondary, and postsecondary education. Seven systems of competency-based instruction are discussed: Program for Learning in Accordance with Needs, Individually Prescribed Instruction, Individually Guided Education, Programmed Logic for Automated Teaching Operations, Computer Curriculum Corporation's CCC 17 Systems, Bell Lab's individualized and group instruction systems, and Oakland Community College Cognitive Style Mapping Program. Three newly emerging systems are also described: Individualized Mathematical Systems, Kettering Secondary School Improvement Project, and Challenge Education. Seven career guidance and information systems are described: Planning Career Goals; AIR Career Guidance Program; Information System for Vocational Decisions; Discover Foundation, Inc.; CHOICES; Career Planning and Support System; and System of Interactive Guidance and Information. Curriculum materials in occupational and vocational education examined include those developed by the Mid-American Vocational Education Curriculum Consortium, Vocational Technical Education Consortium of States, and eleven other educational institutions or agencies. Assessment systems described are The California Test Bureau's (CTB) ORBIT (Objective Referenced Bank of Items and Tests), Houghton Mifflin's SCORE, Educational Testing Service's Program for Assessing Youth Employment Skills, and NOCTI (National Occupational Competency Testing Institute). CTB's data management system, TRACER, is also described. (YLB)

CIOE

COMPONENTS REVIEW

Instructional Management Systems

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SAMPLE COMPETENCY BASED, MODULARIZED INSTRUCTIONAL SYSTEMS AND SYSTEMS COMPONENTS

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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SAMPLE INNOVATIVE COMPETENCY BASED, MODULARIZED INSTRUCTIONAL SYSTEMS AND SYSTEMS COMPONENTS

In order to support competency based, New York State occupational education, a preliminary survey of a variety of extant instructional systems and system components was undertaken. Instructional programs in vocational and occupational education as well as in other areas of elementary, secondary and postsecondary education, were considered.

The purpose of this paper is to identify those systems and program components that would seem to warrant further attention in any attempt to re-evaluate the goals, objectives, and organizational structures of the State's competency based instructional efforts.

CIOE staff[1] conducted a modest field survey of the area. This effort included: 1) a review of the work undertaken by each of the federally funded educational laboratories and university based R & D centers, through 1978; and 2) a preliminary telephone field survey to solicit nominations for exemplary instructional systems and systems components.

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[1] Karen Mitchell, who is also responsible for drafting the major portion of this report.

In this latter effort, staff at all six national vocational and technical curriculum coordination centers, and staff from selected SEA's, school districts, research laboratories and centers, and private research firms were consulted.

The effort thus far points to a number of intact systems, as well as to many instructional systems components, that merit further attention. Seven highly developed systems, or approaches, to competency based instruction have been selected as the best developed, most fully tested, operational systems. Each represents a fundamentally different approach; and each represents significant differences in politics, cost, and start up times.

The intact systems already identified include:

- Program for Learning in Accordance with Needs;
- Individually Prescribed Instruction;
- Individually Guided Education;
- Programmed Logic for Automated Teaching Operations;
- Computer Curriculum Corporation's CCC 17 Systems;
- Bell Lab's individualized and group instruction systems;
- Oakland Community College Cognitive Style Mapping Program.

A brief description of each of these programs follows.

Survey results suggest that a number of other systems may also be available, and in use, especially in the military and in business and industry, but these systems are not easily accessible through the educational literature and referral networks. The materials that are easily accessible are self-contained, programmed curriculum materials.

Three additional, newly emerging systems have also been described. They include:

- Individualized Mathematical System;
- Kettering Secondary School Improvement Project;
- Challenge Education.

Specific follow up, including personal site visits, may be necessary if one wishes to adequately analyze the full range of systems possibilities.

INTACT SYSTEMS

PLAN represents the most comprehensive effort toward the individualization of education to date. Development of this program started in 1967. PLAN stands for "a Program of Learning in Accordance with Needs". It was a product of the cocperative effort of the American Institutes for Research, 14 public school systems, and the Westinghouse Learning Corporation. The PLAN instructional system incorporated basic academic education for grades one through twelve. It included reading, literature, composition, public speaking, grammar, listening skills, science, social studies, and mathematics. The instructional resources of PLAN involved 6000 instructional objectives incorporated into 2600 discrete teaching learning units, involving some 12,000 items of instructional material. There are 1500 criterion referenced performance tests, 133 PLAN achievement tests, and special guidance tests based on the findings of Project Talent, included in the system. Secondary programs of academic study were organized around students' occupational goals.

Various elements of a data oriented career choice system are still available commercially through the California Test Bureau. Elements of computer software are available through McGraw-Hill, and other suppliers.

IPI, Individually Prescribed Instruction, is another ambitious program to develop an individualized system of education. In contrast to PLAN, it is intensive rather than extensive. It offers individualized programs in reading, spelling and mathematics for kindergarten through the sixth grade, in science for kindergarten through the third grade, and in social studies for kindergarten through the second grade. The Learning Research and Development Center at the University of Pittsburgh, and Research for Better Schools in Philadelphia, were responsible for the development, testing, and dissemination of IPI. IPI is an instructional system that includes placement tests and a prescription technology designed to place learners into properly tailored instructional content. It involves pretesting to determine what the learner already knows about the content being taught, and instructional materials built around specified learner objectives. Also included are checkpoints in the curriculum to guide the learner in measuring progress and post-tests to measure the overall mastery of the unit of instruction.

A management system for teachers has also been developed and incorporated, and training programs are laid out in the use of instructional and management systems for administrators, teachers and teacher's aides. A monitoring and day-to-day feedback network designed to improve the instructional and management system is also a vital component of IPI.

This system is designed for elementary school use only. Various algorithms and computer software, as well as basic skills and remedial instruction procedures, may be adaptable for New York occupational education use, however.

The Individually Guided Education program was originally developed nine years ago by the Institute for Development of Education Activities. It is now represented by a national network of

some 3000 schools. Individually Guided Education is primarily an administrative framework for individualizing instruction for elementary schools. It is achieved through an in-service program designed to reorganize and redirect the time, talents, and energy of all concerned in the educational process. IGE is a way of achieving and integrating such concepts as nongradedness and team teaching. It calls for significant teacher and student involvement in the design of the curriculum itself. As such, it is primarily a process oriented dissemination effort. Instructional processes represent the heart of IGE. The processes provide each student with an appropriate learning system built on a continuous cycle of assessment, objectives, diversified learning opportunities, and reassessment.

PLATO stands for Programmed Logic for Automated Teaching Operations. It was developed by the computer-based educational research laboratory at the University of Illinois, Urbana with assistance from the Control Data Corporation. PLATO is perhaps the most widely used interactive, computer assisted, competency based instructional system in operation. PLATO allows each student to work through a variety of subject areas at his or her own pace. Some of the subjects programmed in PLATO are biology, economics, foreign languages, statistics, geography, psychology, political science, and veterinary medicine. Presently there are about 150 subjects with over 6,000 lessons being taught through the PLATO system. PLATO is currently being used in vocational education instruction in Florida and in Maryland as well as a variety of other states. There would be excellent opportunity to use PLATO in a variety of introductory, content oriented, modules for either core units (e.g., tool care, shop safety), or for high technology areas (e.g., electronics, dental technician).

Computer Curriculum Corporation in Palo Alto, California has developed a series of computer-assisted instructional programs in mathematics, languages and reading. The CCC 17 systems are complete instructional programs designed for use at the early elementary,

middle school, and young adult levels. They are being used now in the learning centers of several New York BOCES.

This company is the spin-off of the work of Patrick Suppes of Stanford University. Suppes is the father of low cost CAI as we know it today, and was the driving force behind the U.S. Air Force committment to CAI. He was the "Godfather" of Duncan Hansen's CAI center at Florida State University.

The Bell Systems have for many years been pioneers in innovative technical instruction. The Bell Laboratories and the Bell Telephone System have been devoted to the conceptualization and development of advanced instructional technologies for use in their employee training programs. In 1958, Bell Labs, along with General Electric, Litton Industries, and others in that era, introduced the programmed instruction concept. Today, the Bell training efforts remain a model of exemplary industrial instructional technology utilization. Their individualized and group instruction systems make use of a wide range of auto-tutorial, auto-instructional, paper-and-pencil, textbook oriented and computer assisted approaches.

AT&T has recently sponsored the publication of an instructional development manual entitled, Standards for the Development of Training for the Bell Systems. The work of Robert Mager, Leslie Briggs and Robert Gagne are in this tradition.

This work, as well as the 10-year work of Florida State University for the U.S. Air Force, are musts for serious review. They represent the two longest standing business-military committments to modularized, competency-based, technology supported vocational training efforts in the country.

The research at Oakland Community College, in cognitive style mapping has shown it possible to develop a personalized educational

program on a large scale that provides a diversity of approaches for individual student learning. Oakland CC is a three campus community college with a strong association with General Motors and the Detroit automotive industry.

Like many of the programs discussed earlier, this effort has also been underway for almost a decade. Unlike some of the more recent, and superficial, efforts at cognitive mapping, the process at OCC involves the combination of student questionnaire data and diagnostic information. The data are used jointly to plan a student's courses of study and design methods and media appropriate to individual students' learning style, especially, occupational education.

In addition to specifications of the curriculum, and performance levels expected for individual students, the OCC focus on learner style makes it possible to identify educational methods best suited to the student's style. The principles of seeking an optimal match between learner and instructional style are relevant to the development of instructional approaches and instructional materials in vocational and occupational education.

To date, cognitive style mapping techniques have been used in all 73 of Oakland Community College's occupational education programs. Fifty-five percent of the college's 22,800 students are enrolled in the vocational technical program. An example of Oakland's vocational technical curriculum is their automotive mechanics program. Oakland's automotive center has 24 bays, and offers programs in automotive servicing, automotive engineering technology, and diesel truck and heavy equipment repair.

The following three efforts are newer efforts and have only tangential, and potential, bearing on occupational education.

The Individualized Mathematical Systems is a low-cost mathematics curriculum for grades one through six. IMS was developed by the Center for Individualized Instructional Systems in North Carolina. IMS covers ten topics: numeration, addition, subtraction, multiplication, division, fractions, mixed operations, money, time and measurement. Within each topic there is a carefully designed, arranged sequence of skills to be learned. The skills are organized into nine levels of difficulty, and each skill or behavioral objective is incorporated into a separate skills folder. There are 376 skills in the IMS curriculum. The value of this system is either as a basic skills remediation element, or as a management algorithm.

Challenge Education is based on the "walk-about" model conceived by Maurice Gibbons of Simon Fraser University. This model was first implemented on a large scale in the Lilly Endowment-sponsored project, "Learning Unlimited of Indianapolis," now in its seventh year of operation. This system might be one possible alternative for home school students, industrial arts students, "multi-occ" students and career education or career exploration students.

The Kettering Secondary School Improvement Project is a program that combines curriculum components of IGE and Challenge Education. The Kettering Project was launched in January 1980. The field testing and diffusion stages are scheduled for January 1981. Curriculum programs are directed at students becoming increasingly self-directed through planned activities, through parents becoming active participants in the education of their children, through each student pursuing study in some area of his or her own choosing, and through schools increasingly assuming the important role of coordinator and linker of resources in an effort to increase the positive impact on students while reducing the direct role of the school. This is another example of school-community interaction.

Having considered several intact vocational or vocationally relevant instructional systems, attention is now turned to selected instructional systems components. The systems elements of greatest interest are those that relate to: student guidance, student assessment, curriculum, and to systems monitoring and data management.

GUIDANCE SYSTEMS

Innovative approaches to student guidance are evidenced in the following career guidance and information systems.

The Planning Career Goals program has been designed to assist the counselor in facilitating the planning function with students in grades 8-12. The goal of PCG is to provide individuals with sufficient information about themselves, and about careers, to enable them to make realistic and satisfying life and career plans. This is the commercial version of one aspect of the PLAN Guidance System. It is the most thoroughly data based, and validated, commercial vocational guidance system on the market today. This is essentially a testing and counselor based system.

The AIR Career Guidance Program. Developed originally for Project PLAN, this system is designed to improve students' long-range vocational goal formulation skills, and can be used in a BOCES or home school resource center with minimally trained staff. Professional counselors are not necessary. Self-instructional modules are directed at helping students arrive at decisions on the basis of informed choice. The modules are self-paced, and students are instructed to consult reference materials for supplementary information. Career guidance tests provide evidence of students' developed abilities and interests. Test results are used in making empirical comparisons of like traits for individuals in various occupations.

Some adaptation of these materials would be needed to make them maximally appropriate for NY occupational education use.

ISVD, the Information System for Vocational Decisions, was developed at the Harvard Graduate School of Education in the late 1960s. The system was made up of two components: (1) a computer data base which contained a series of templates defining patterns of student response, and (2) a series of computer access routines through which students supplied information about their vocational, home and family, military and social goals. The system was based on the expectation that individuals would refine and expand their decision making skills through multiple interactions with the information system. Like Project PLAN, the original experimental model of ISVD has now been retired and is not operable, but a modified version of the system, the Guidance Information System, has been developed commercially and is being marketed by Time Share Incorporated.

Discover Foundation Inc. In Maryland is marketing a career decision making system called the Computerized Vocational Information System (CVIS). At this writing, CVIS is being field tested in Villa Park, Illinois. The authors of the system are currently working on two additional systems, the Discover System and the Explore System.

CHOICES, the Computerized Heuristic Occupational Information and Career Exploration System, has been developed by the Canadian Government Manpower and Immigration Service. CHOICES is presently in use in Canada, North Carolina and Florida.

The Career Planning and Support System (CPSS), developed by the Ohio State Center for Vocational Education, is a management system for the development and establishment of an individualized career

guidance program. CPSS is individually tailored to schools and school systems on the basis of locally-defined objectives for career guidance. CPSS encourages the team approach to the conceptualization of career guidance. The system is organized around needs analyses, the setting of career goals and objectives, and the use of career development units. The system includes a listing of over 600 methods and materials for use in career guidance. CPSS includes an evaluation component directed at the assessment and updating of in-place career guidance programs.

SIGI. The Educational Testing Service has recently developed an interactive computer system designed to help students make career decisions. SIGI, the System of Interactive Guidance and Information, takes students' responses to questionnaires, their course grades and demographic data, and matches student response patterns to those characteristic of people involved in particular professions.

CURRICULUM MATERIALS

Our examination of curriculum materials in occupational and vocational education begins with consideration of materials developed by the Mid-American Vocational Education Curriculum Consortium and with the instructional modules compiled by the Vocational Technical Education Consortium of States.

MAVECC is a consortium of the state agencies that administer the vocational programs in Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, Louisiana, Arizona, Arkansas, New Mexico, Colorado and Missouri. The objectives of the Consortium are to develop mutually needed instructional materials and, in doing so, to minimize duplication of effort and expense involved in developing and distributing vocational curriculum materials. The Consortium is devoted to providing high quality curriculum materials at low prices

and to making the products easily accessible to all member and non-member states. Instructional materials are developed in response to high priority needs established by the states. Each of the modules, or units of instruction, involves three components. The first component is a listing of relevant performance objectives. The second component offers suggested activities for instruction. Criterion referenced measuring instruments are the final component in each unit. The Consortium provides in-service training for instructors in the use of the materials and claims to have developed and disseminated over 35,000 materials. The obvious difference between MAVECC and V-TECS materials is that the MAVECC system specifies instructional activities and assessment procedures as well as objectives.

V-TECS, the Vocational-Technical Education Consortium of States, is also a cooperative research and development venture. The member states are Alabama, Georgia, Florida, Illinois, Indiana, Kentucky, Louisiana, Maryland, Michigan, Mississippi, New York, Pennsylvania, South Carolina, Tennessee, Virginia, West Virginia and Wisconsin. The curricular efforts of V-TECS are directed at the needs of students of local and state education agencies and of business and industry. V-TECS materials are designed to provide job relevant performance objectives and performance guides for teaching vocational education, and for testing achievement in various occupational areas. Unlike materials developed by the Mid-American Vocational Education Consortium, the V-TECS modules are directed primarily at the identification of high priority curricula. Relevant instructional methods and materials are not addressed. V-TECS products are developed in accordance with established procedures for the identification of tasks, for the specification of performance objectives and performance guides by job structures and career knowledge, and for the listing of necessary tools and equipment.

EBCE. Although career education and occupational are not synomous, there are some areas of mutual support. The materials developed under the aegis of the Experience Based Career Education are worthy of note. The Experience Based Career Education program (originally conceived as an Employer Based Career Education program) is a model for providing career education using businesses and community agencies as academic learning sites. This is a full time alternative high school program for sophomores, juniors, and seniors. The model provides an individualized approach for students to acquire basic life skills and to identify, assess and refine career information in a field-based career development program. The Northwest Regional Educational Laboratory, the Far West Laboratory, Research for Better Schools, Inc., and the Appalachia Educational Laboratory cooperatively provide assistance to state agency personnel in delivering EBCE services to constituent schools.

The materials developed by Northwest Regional Labs are characteristic of the instructional products put out in conjunction with EBCE. NWREL's Education and Work Program has designed materials to be used by planners and staff in implementing the total EBCE program. The EBCE staff handbooks are entitled: Management and Organization; Curriculum and Instruction; Employer/Community Resources; Student Services; The Community Resource Person's Guide for Experience Based Learning; and Evaluation. Student materials include: Student Guide to Writing a Journal; Student Competencies Guide: Survival Skills for a Changing World; Student Record of Community Exploration; and Project Ideabook.

While the goals of Career Education are, of course, greatly different from the goals of occupational education, EBCE developers have had to wrestle with the problem of creating an entirely new eductional alternative. Some of the staff development and curriculum development guides they have had to develop may be of some value for the introduction of serious competency based instruction in New York, especially when problems of "futured" curricula are addressed.

The Aerospace Education Foundation has developed a series of criterion referenced, self-paced course packages in 58 vocational areas. Each course package includes texts, workbooks, programmed units, optional audio visual materials, and instructor materials. Materials are available in the fields of automotive mechanics, communication arts, computer science, construction trades, electronics, soldering, environmental control, metal trades, meteorology, and paramedicine and health care. There are military training materials, typically from the Air Force, that are being made available through the Foundation. A few years ago, the National Center for Vocational Education of Ohio State University also published a catalogue of "Military Curricula for Vocational and Technical Education" which are available through the General Micro Film Corporation.

The Oklahoma State Department of Education reports having developed a set of competency based vocational education materials. The Oklahoma development effort has resulted in a collection of between 70-75 products which are adaptable by local education agencies both within and outside the state. Like V-TECS, the products focus on vocational education competencies; they do not prescribe instructional procedures. Teachers are advised to localize, personalize, supplement, and motivate materials in local adaptation.

The University of Texas is reported to have developed a computer-based competency retrieval system in the areas of marketing and distributive education. The Texas materials are designed to help institutions define and develop instructional resources. Competency listings are currently being developed in other areas of the vocational education curriculum.

Attending to the needs of special education students, the University of Missouri Curriculum Center has compiled a curriculum in vocational education for handicapped occupational and industrial

education students. The materials in this curriculum are reputed to be of low reading level, highly graphic, and individualized. The materials are designed to prepare special education students to enter the conventional vocational education program. As of this date they indicate that they have 13 units in welding, electricity and automotive service. These materials may be used in self-contained special education classrooms. They may also be used for mainstreamed students, and as a base curriculum in the regular occupational and vocational education programs.

At East Texas State Occupational Curriculum Laboratory, a component of the Texas Curriculum Center, audio-tutorial materials have been developed in the area of small engine repair for handicapped and academically disadvantaged students. Additional audio-tutorial materials will soon be developed in other areas of industrial training.

The School District of Philadelphia is reported to have developed Personalized, Individualized, Vocational Occupations Training (PIVOT) materials. These materials are designed to develop entry-level competency in secondary school vocational students. The materials are developed for use in skills centers, comprehensive high schools, area vocational-technical schools, and special education occupational schools. The PIVOT materials are criterion-referenced and modularized, and may be presented using individual sound-on-slide projectors or using more conventional methods of instruction.

AIDS, the Automated Instructional Development System, was reported in the telephone survey as an innovative system consisting of a special-purpose computer; innovatively designed software; and individualized adaptive instruction. This computer-assisted instructional system involves module objectives, entry characteristics assessment, program instruction, remediation, student feedback, and refresher training. To date, additional information on AIDS has not yet been received.

The Vocational Education Media Center at Clemson University has developed a series of eleven task and in-basket simulations designed to provide individualized instruction in office occupations courses. Modules are staggered according to difficulty level and include statements of objectives, prerequisite student experiences, necessary equipment, supplies, and resources; description of the simulation situation; instructions for learning tasks; and worksheets. Modules are developed around the performance objectives of the V-TECS catalogues.

The Kentucky CBVE Project has developed 300 competency-based vocational education instruction modules in five occupational areas. These areas are automobile mechanics, air conditioning and refrigeration, court and conference reporting, alteration, and gardening and housekeeping. Slide/tape presentations accompany the modules.

Twelve instructional modules, concerned with the human aspects of working in organizations, have been developed at Weste[illegible] Illinois University. The materials have been developed for use at various educational levels ranging from high school to adult and continuing education. Among the module titles are: (1) Working in Organizations; (2) Motivation for Work; (3) Using Creativity at Work; (4) Authority and Responsibility; (5) Coping with Conflict; and (6) Adopting and Planning for the Future. Each module is organized according to objectives, skills, activity descriptions, and follow-up. The modules are developed around competencies that workers need to maintain an occupation.

Summary. There is no shortage of curricular materials, i.e., lists of objectives, and even instructional suggestions. The fundamental problems appear to be: how modularized instruction,

using those materials, might be adequately managed; how instructors might be induced to commit themselves to, and utilize, competency based instruction; how one can assure that the curricula taught by instructors reflect on adequately "futurized" programs, i.e., how to assure proactive timeliness; how to assure meaningful and informed student career, and thus occupational program, choice.

ASSESSMENT SYSTEMS

Significant assessment systems have been developed by the Educational Testing Service, Houghton Mifflin, The California Test Bureau-McGraw-Hill, and by the National Occupational Competency Testing Service.

ORBIT, the Objective Referenced Bank of Items and Tests developed by CTB, offers a bank of basic academic skills items from which customized criterion referenced tests can be produced. The system is designed to permit educators to select objectives most appropriate to their local educational goals and programs. Each objective is measured by at least four items for the kindergarten through grade 12 curriculum. The ORBIT computer scoring system however, is an open system, and can be used to score mastery of occupational education objectives just as well. The customer can supply the test items or CTB will write them for a fee.

Houghton Mifflin's SCORE is a similar criterion referenced testing service, deriving from PLAN, which combines performance objectives in reading, oral communication, spelling, writing, and mathematics with an extensive bank of multiple choice test items. SCORE is designed for use in grades one through eight. The teacher specifies the performance objectives and the number of items to be measured for each objective, and a set of custom test booklets are

computer-generated. SCORE scores the tests and reports results by students, class, school, and district. Like ORBIT, SCORE is an open system.

The Program for Assessing Youth Employment Skills (PAYES), on ETS test, is designed to assist program directors, counselors and teachers in counseling adolescents and young adultr with low verbal skills as thev prepare for entry-level employment. Based on research by ETS, PAYES is designed for enrollees in CETA centers, skills centers, vocational high school special needs classes, adult based education centers and adolescents and young adults in correctional institutions. PAYES contaius measures of attitude concerning job-holding skills, supervision, and self-confidence; cognitive measures of job knowledge, job-seeking skills, and practical reasoning; and the vocational interest inventory. PAYES is designed to be administered orally to small groups in an informal manner. It would be a useful test to screen students on worker readiness dimensions.

NOCTI, the National Occupational Competency Testing Service, was formed thirteen years ago with the purpose of assessing pre- and post-certification teacher competence in the industrial, technical and trade vocational areas. NOCTI has recently instituted a system of student testing in the areas of industrial, technical, trade, agriculture, home economics, business and health vocations. NOCTI is presently in its second year of test development under this system. An eight-state consortium is involved in the construction, field testing and revision of this series of timed, nationally normed vocational examinations. It has recently been reported that Ohio has withdrawn from the consortium. Other similar competency test development efforts are being conducted by Ohio, several other states, and USOE-BAVTE via contract with the American Institutes for Research.

SYSTEMS MONITORING AND
DATA MANAGEMENT

CTB has also offered one of the few commercially available data-management systems designed expressly for modulized, computer-based, or individualized instructional systems. Like so many of the other commercially available products relevant to instructional systems, TRACER also derives from early work in the development of PLAN.

TRACER is a computer-managed instructional system that works with any objectives-based program by monitoring and guiding student progress. Unlike computer-assisted instruction, the TRACER system does not provide a course of study. It is solely a computer software package that serves as a management aid for teachers.

The TRACER programs are adaptable to all curricular and all instructional materials. They aid the teacher in monitoring individual student progress by checking classroom tests, reporting test results, alerting teachers to possible problem areas, providing teachers with a comprehensive report of students' progress and achievement, and prescribing up to nine different learning activities per unit. The relevance to ISSOE is clear and immediate. The implementation of fully operational (as contrasted to developmental) computer support, however, exposes the shortcomings of the balance of the system (e.g., curriculum and supply in adequacies, test irregularities, teacher inconsistencies, gaps in programs) in a most embarrassing way.

CONCLUDING COMMENTS

Nominations for exemplary instructional systems, and systems components, are still being received. We anticipate an appreciably expanded listing in future reports. The names, affiliations, and phone numbers of people contacted during our preliminary survey are listed below. Follow-up information has been requested from project directors of many of the programs that have been discussed. New York systems have not been addressed. We are waiting for initial responses to inquiries about such programs as the Fox Valley Technical Institute computerized, competency-based occupational education program; the 916 Vocational Technical Institute computerized occupational education program; and the Army Research Institute computer-assisted instruction programs.

In brief, if one were to engineer a major improvement of New York's competency based educational delivery system, with the simplest and most reliable, yet reasonably low cost components, attention should be given to:

1) A non-computerized, but data oriented career guidance system for early career choice and clarification, such as the AIR Career Guidance Program which can be adapted to New York needs very easily;

2) The ORBIT system for criterion referenced testing (performance recording) purposes;

3) The TRACER system for computer based record keeping;

4) The military-industrial model of performance training as reflected in the work of Mager, Gagne, Briggs, The Bell System, etc.;

5) The Instructional Methods Options of Oakland C.C. and EBCE;

6) The curriculum materials resources of the military as well as MAVECC and V-TECS;

7) The combined Performance Assessment Test approaches of Ohio State and AIR as well as NOCTI; and,

8) The implementation-field service strategies of PLAN, IGE.

The success of such an effort would depend on the operational integrity of the central systems design. The usefulness of such an effort will deal on the intellectual quality of the States futuring efforts.

The persons who have contributed thus far to this survey are:

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